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(51) INT CL^6
H05K 7/14 // H04N 5/64 , H05K 9/00

(52) UK CL (Edition P)
H1R RBS
U1S S2206

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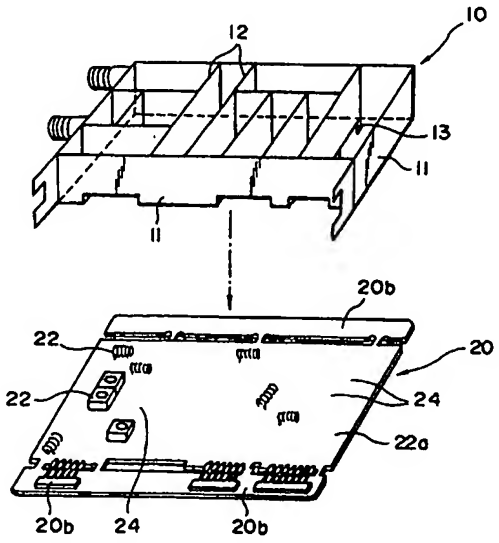
GB 2311416 A US 4628412 A

(58) Field of Search
UK CL (Edition O) H1R RBH RBS
INT CL^6 H05K
ON LINE,W.P.I.

(54) Mounting a printed circuit board in a frame

(57) The printed circuit board 20 is provided with edge sections 20b connected by bridges (20c, Fig 8) to the main section of the board. After inserting the board into a metal frame 10 and soldering legs 13 to holes in the board, the edge sections 20b which protect terminals (30) are removed by cutting the bridges (20c). Finally the connecting sections (30a) of the terminals are cut to isolate individual terminals. The circuitry on the printed circuit board may be a h.f. device such as a television tuner.

FIG. 6



GB 2 318 690 A

FIG. 1

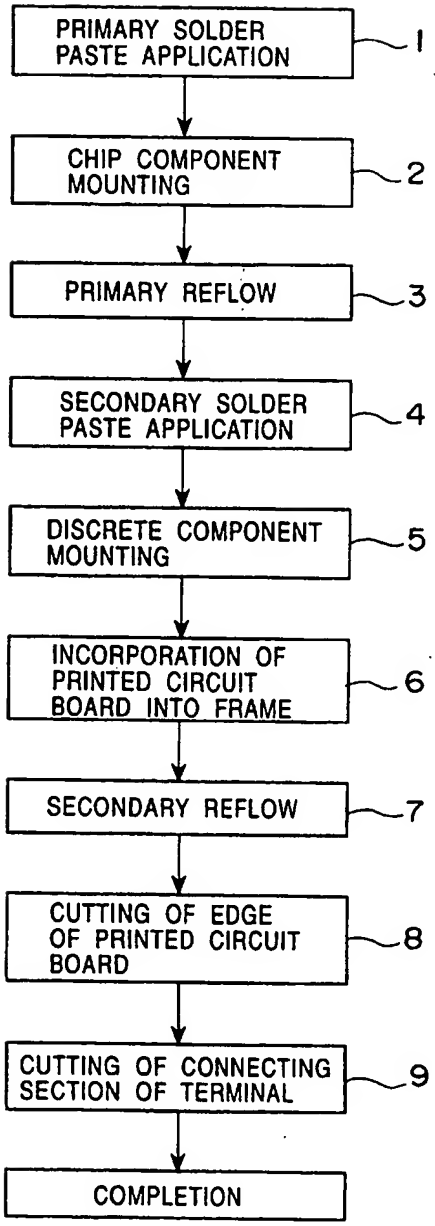

PRIMARY SOLDER PASTE APPLICATION
1
CHIP COMPONENT MOUNTING
2
PRIMARY REFLOW
3
SECONDARY SOLDER PASTE APPLICATION
4
DISCRETE COMPONENT MOUNTING
5
INCORPORATION OF PRINTED CIRCUIT BOARD INTO FRAME
6
SECONDARY REFLOW
7
CUTTING OF EDGE OF PRINTED CIRCUIT BOARD
8
CUTTING OF CONNECTING SECTION OF TERMINAL
9
COMPLETION

FIG. 2

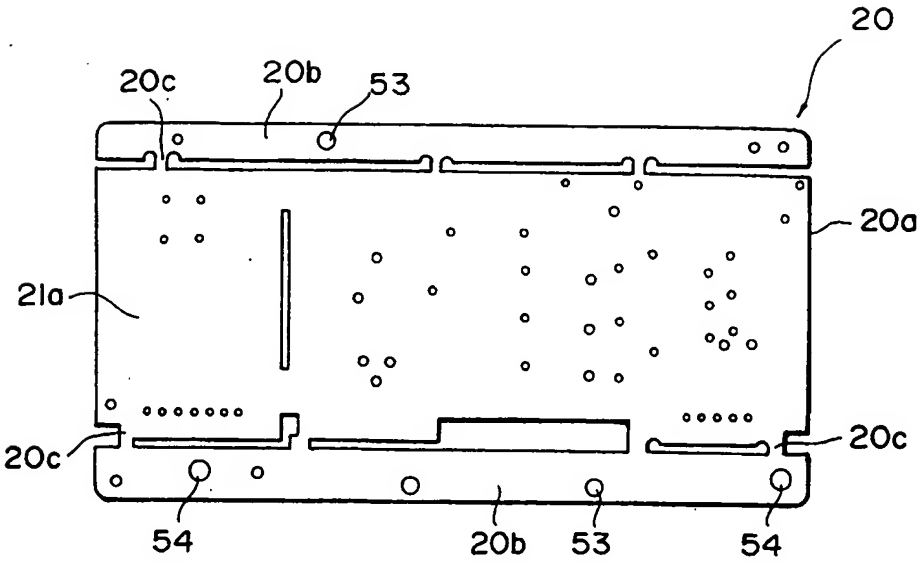

20
20c
20b
53
20a
21a
20c
20c
54
20b
53
54

FIG. 3

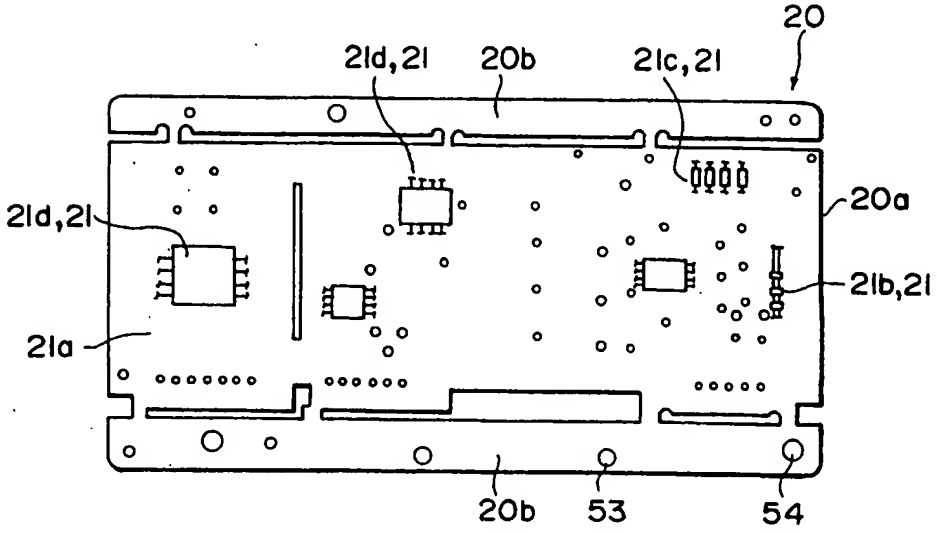

20
21d,21
20b
21c,21
20a
21d,21
21b,21
21a
20b
53
54

FIG. 4

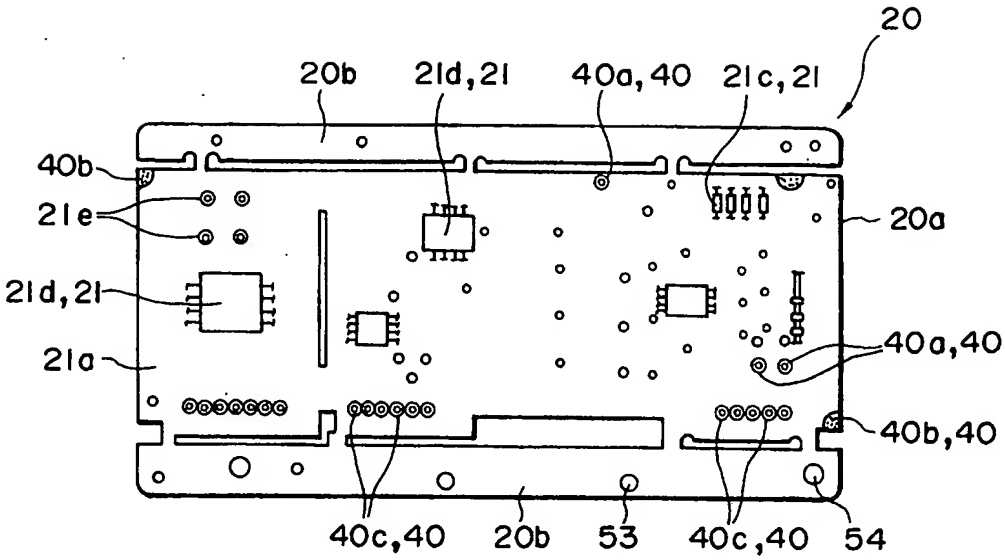

20
20b
21d,21
40a,40
21c,21
40b
21e
20a
21d,21
21a
40a,40
40b,40
40c,40
20b
53
40c,40
54

FIG. 5

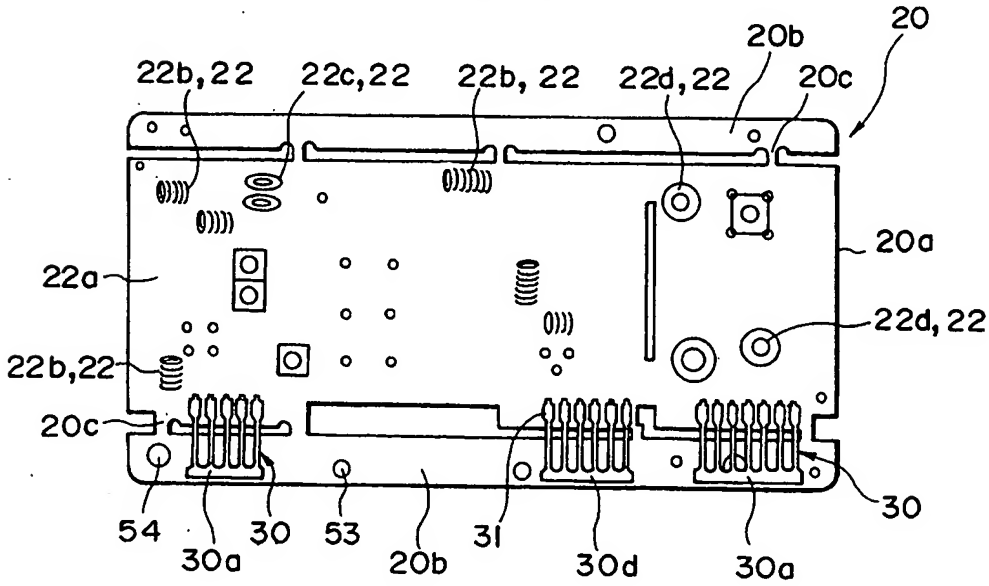

20
20b
22b,22
22c,22
22b,22
22d,22
20c
20a
22a
22d,22
22b,22
20c
54
30a
30
53
20b
31
30d
30a
30

FIG. 6

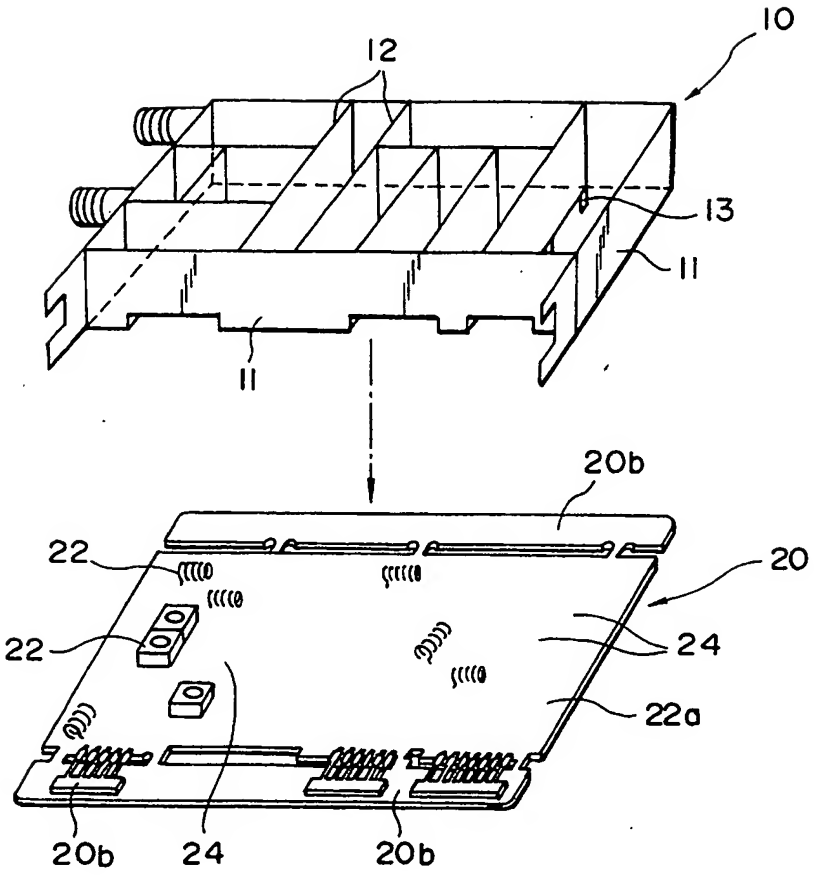


FIG. 7

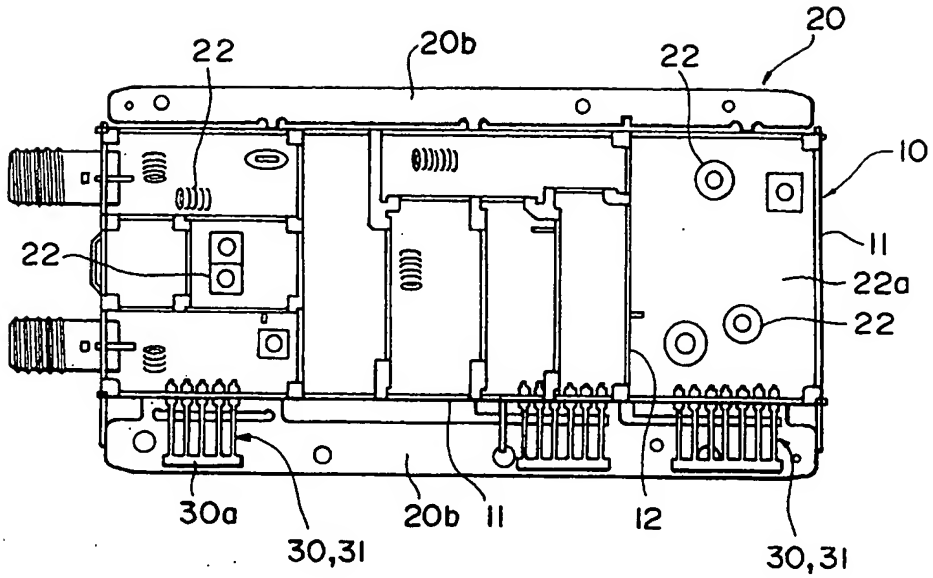

20
22
20b
22
10
22
11
22a
22
30a
30,31
20b
11
12
30,31

FIG. 8

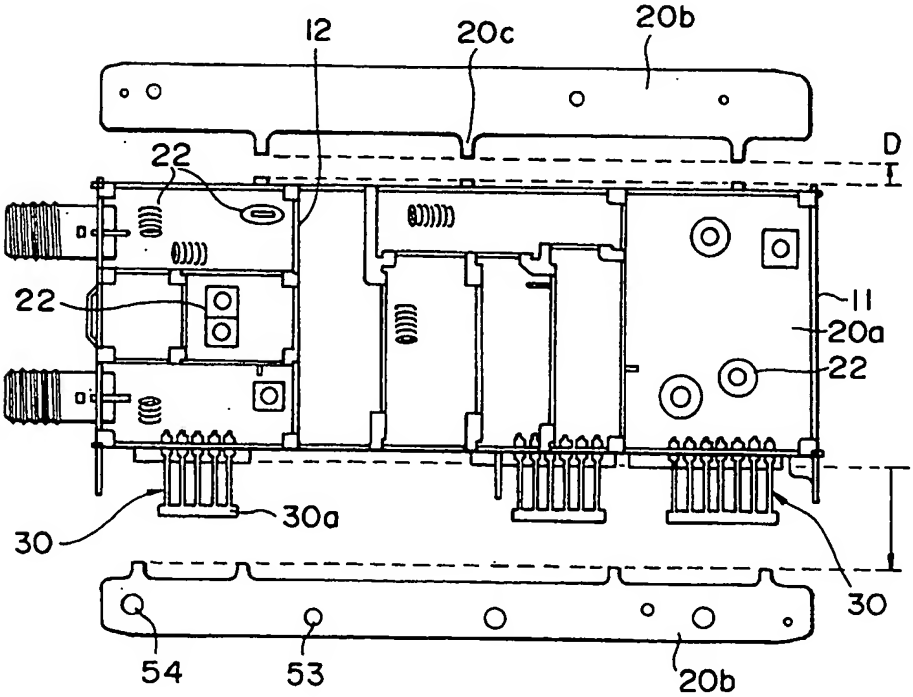

12
20c
20b
D
22
22
11
20a
22
30a
30
30
54
53
20b

FIG. 9

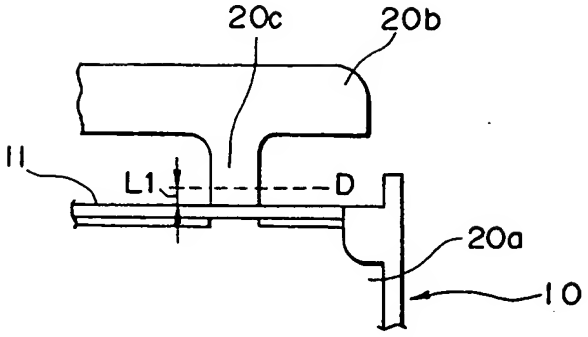


FIG. 10

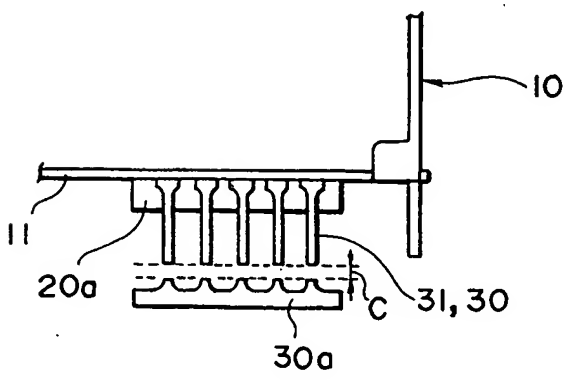


FIG. 11

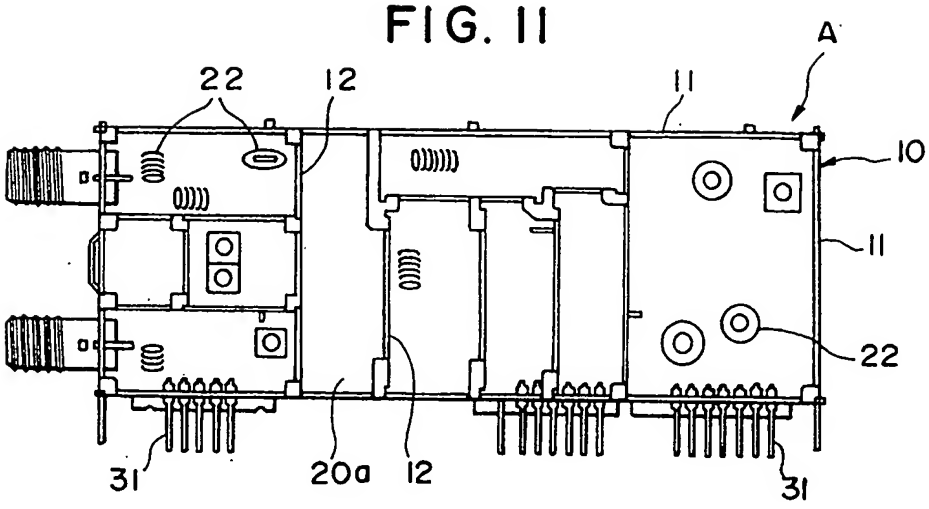


FIG. 12

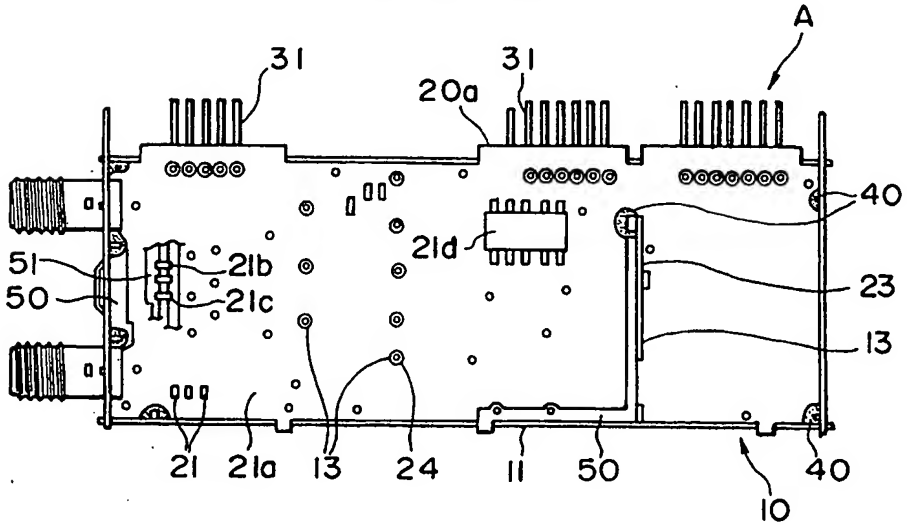


FIG. 13

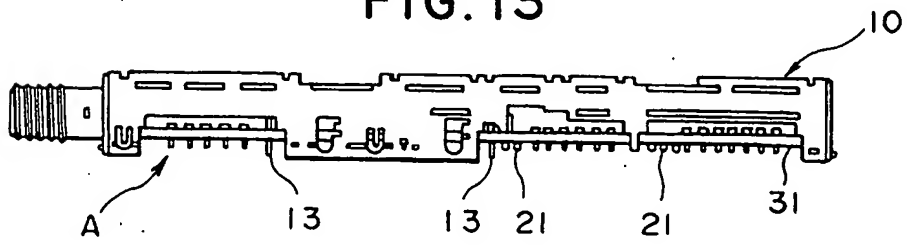


FIG. 14

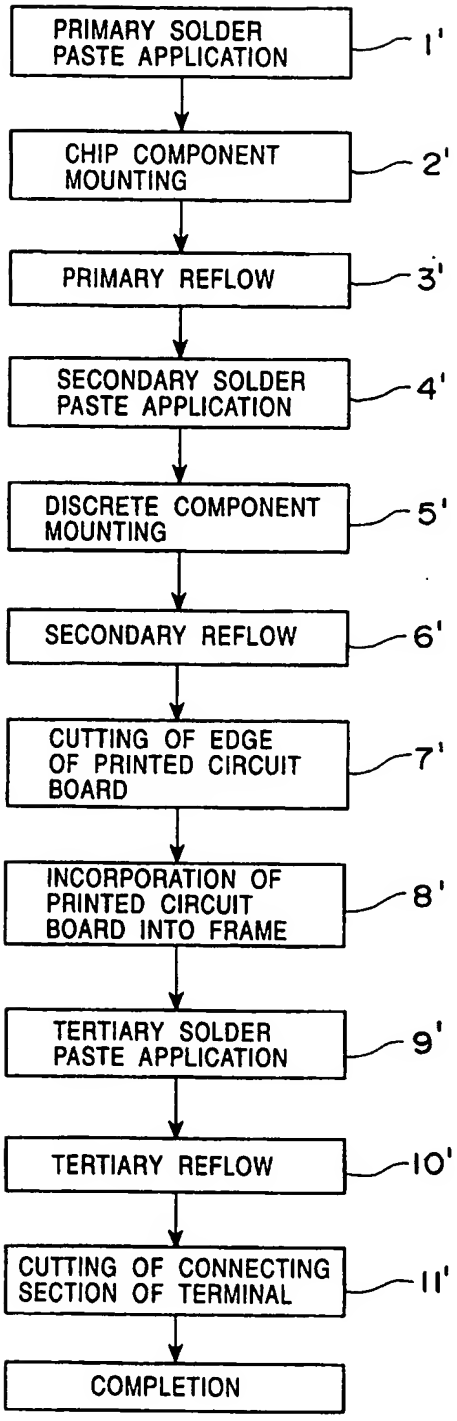

PRIMARY SOLDER PASTE APPLICATION
1'
CHIP COMPONENT MOUNTING
2'
PRIMARY REFLOW
3'
SECONDARY SOLDER PASTE APPLICATION
4'
DISCRETE COMPONENT MOUNTING
5'
SECONDARY REFLOW
6'
CUTTING OF EDGE OF PRINTED CIRCUIT BOARD
7'
INCORPORATION OF PRINTED CIRCUIT BOARD INTO FRAME
8'
TERTIARY SOLDER PASTE APPLICATION
9'
TERTIARY REFLOW
10'
CUTTING OF CONNECTING SECTION OF TERMINAL
11'
COMPLETION

FIG. 15
PRIOR ART

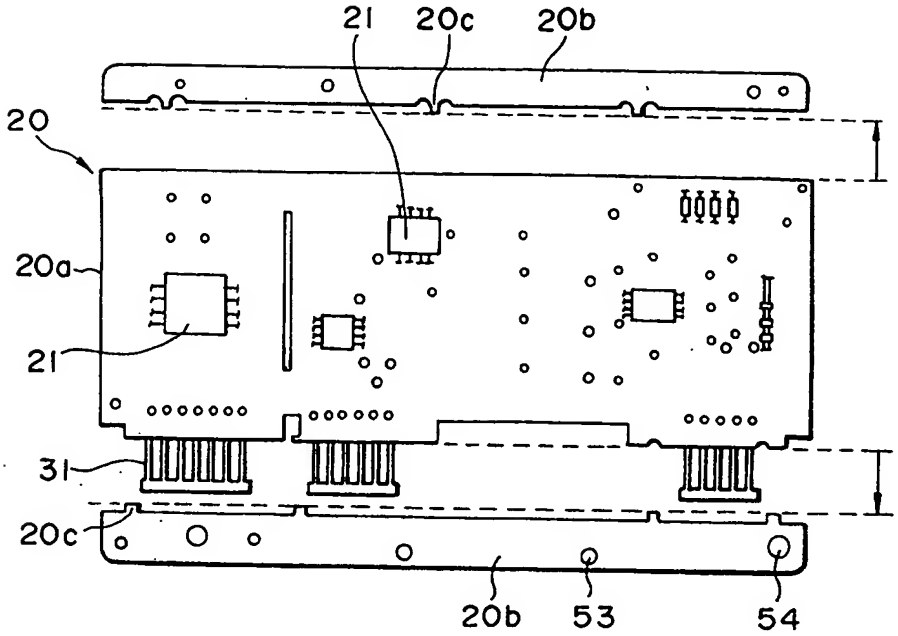


FIG. 16
PRIOR ART

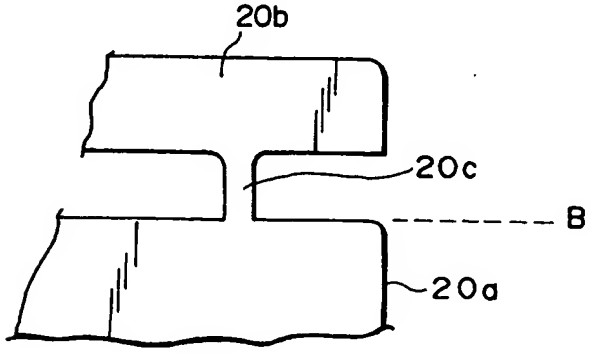


FIG. 17
PRIOR ART

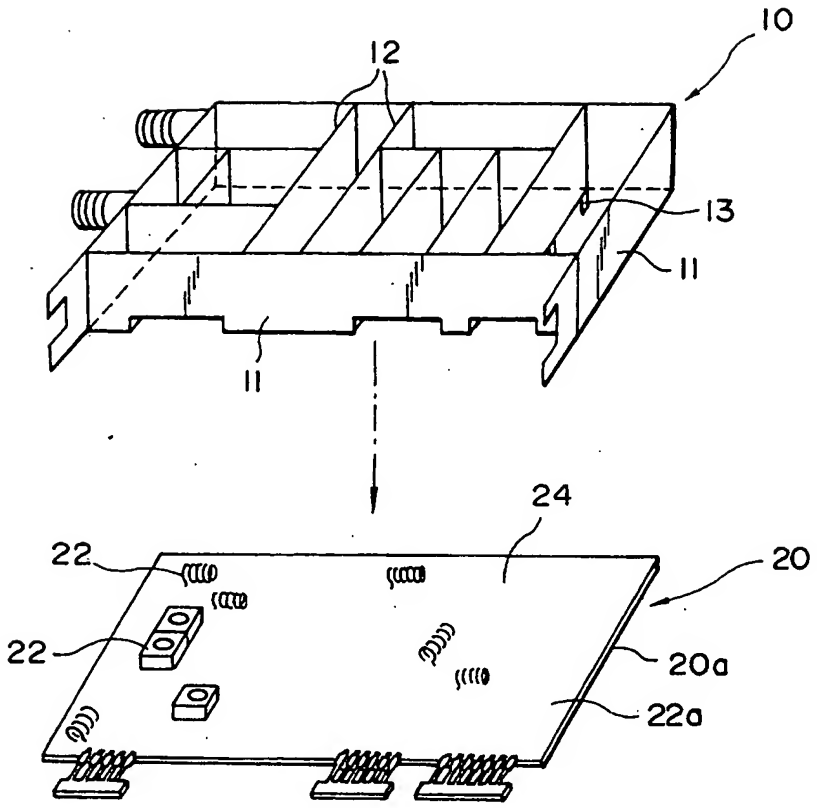


FIG. 18
PRIOR ART

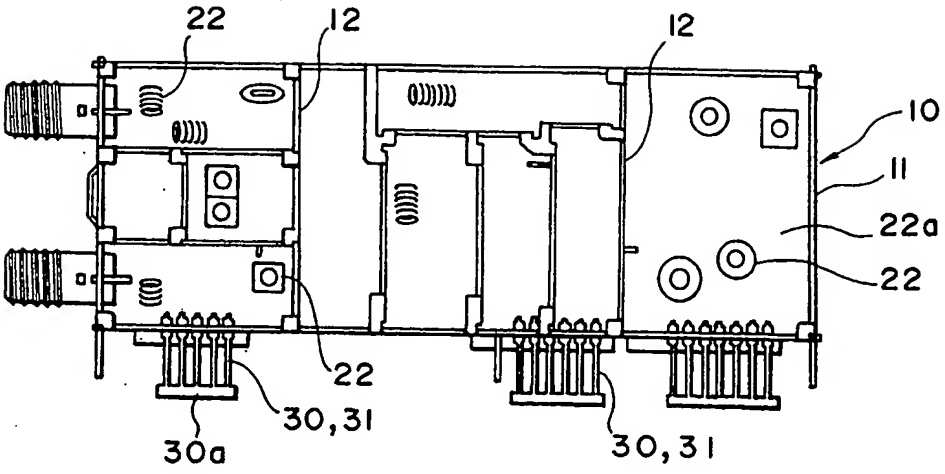


FIG. 19
PRIOR ART

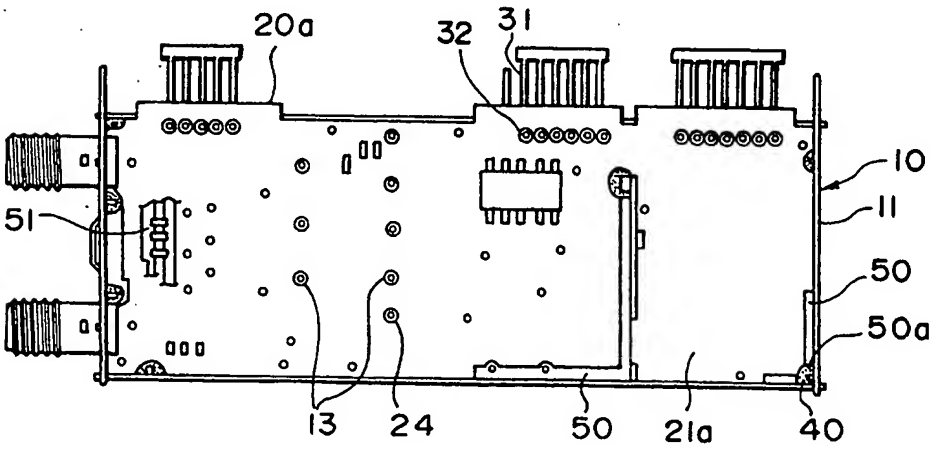


FIG. 20
PRIOR ART

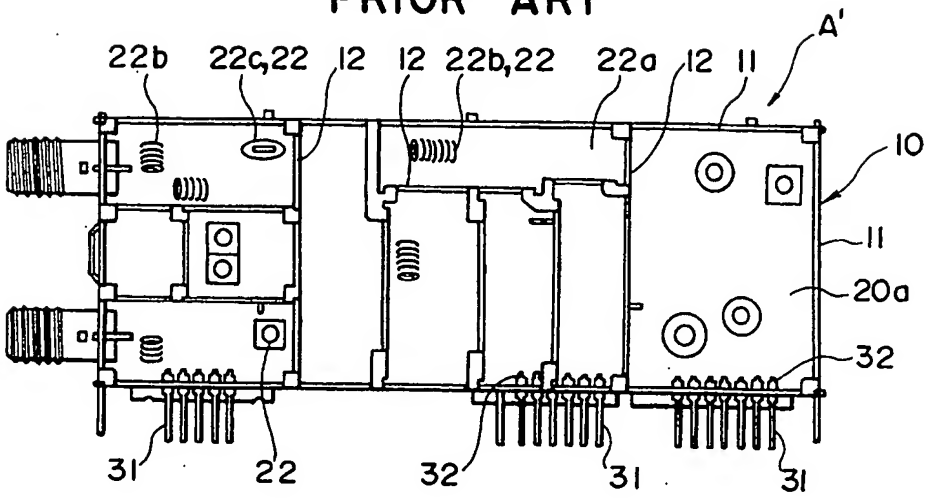


FIG. 21
PRIOR ART

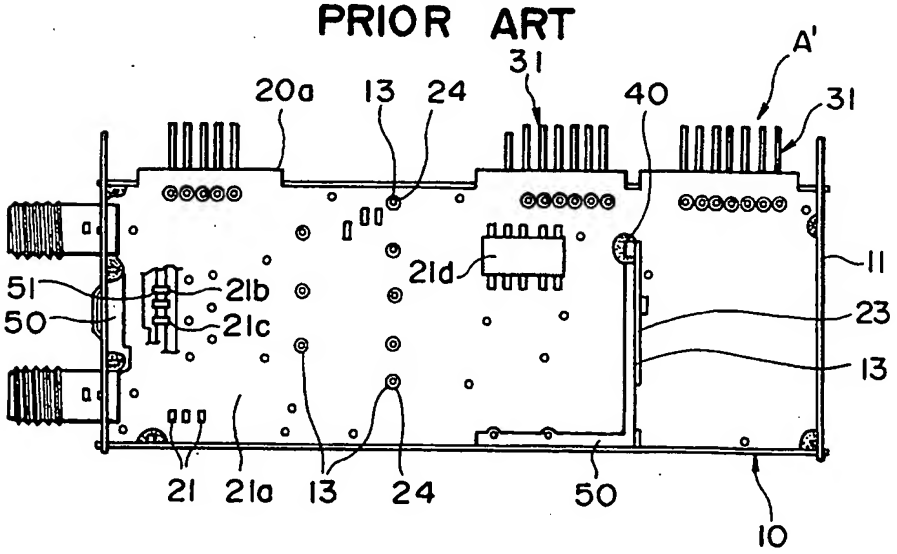
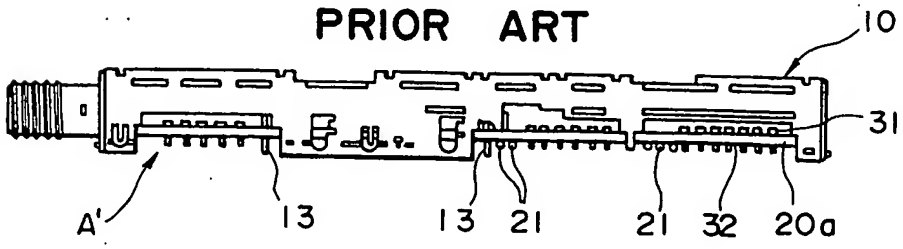


FIG. 22
PRIOR ART



METHOD OF MANUFACTURING HIGH-FREQUENCY DEVICE

The present invention relates to a method of manufacturing a high-frequency device in which a printed circuit board section with electric components, such as chip components and discrete components, mounted thereon is engaged with and fixed to a frame.

First, the schematic structure of a conventional high-frequency device will be described.

Fig. 20 is a plan view showing a finished product of a conventional high-frequency device for use in a television receiver, Fig 21 is a bottom view of the device, and Fig. 22 is a front view of the device.

In the figures, a high-frequency device A', such as a television tuner used in a television receiver, is composed of a frame 10 made of a flat metal material, and a printed circuit board section 20a made of glass epoxy resin or the like. The frame 10 comprises an outer side wall 11 formed by stamping, bending and the like to surround the inside space on all sides in the square form, a plurality of inner walls 12 for dividing the inside space surrounded by the outer side wall 11, and a plurality of leg sections 13

projected downward from the inner walls 12 (see Fig. 22).

The printed circuit board section 20a is composed of a first surface 21a, on which a wiring circuit 51 (partially shown) made of copper foil is formed in a desired pattern, earth patterns 50 are located at specific positions, and electric components 21, such as a cylindrical or prismatic chip resistor 21b, a chip capacitor 21c and an integrated circuit 21d, are mounted on the wiring circuit 51, and a second surface 22a on which discrete components 22, such as a coil 22b and a transformer 22c, are mounted. Furthermore, a plurality of terminals 31 to be used for input and output of signals and the like are fixed on the second surface 22a to project outward along one side of the printed circuit board section 20a. Still furthermore, a plurality of holes 24, through which the leg sections 13 of the frame 10 are inserted, and a through hole 23 are formed on the printed circuit board section 20a.

As for the frame 10 and the printed circuit board section 20a thus constructed, the printed circuit board section 20a is engaged with and fixed to the outer side wall 11 of the frame 10 so that the second surface 22a with the discrete components 22 mounted thereon faces upward. Moreover, the leg sections 13 of the frame 10 inserted into the holes 24 of the printed circuit board section 20a and the earth patterns 50 of the printed circuit board section

20a are connected by solder 40.

The high-frequency device A' having the above-mentioned structure functions to, for example, subject an input signal from an antenna (not shown) of the television receiver to signal processing, such as frequency conversion and amplification. This is allowed by soldering the terminals 31 onto a mother board (not shown) of the television receiver.

Next, a conventional method of manufacturing the high-frequency device A' thus constructed will be described in detail with reference to Figs. 2 to 5 and 14 to 22.

Fig. 2 is a plan view of a conventional printed circuit board body onto which primary solder paste is applied, Fig. 3 is a plan view showing the state in which chip components are mounted on the conventional printed circuit board body, Fig. 4 is a plan view of the conventional printed circuit board body onto which secondary solder paste is applied, Fig. 5 is a plan view showing the state in which discrete components are mounted on the conventional printed circuit board body, Fig. 14 is a chart explaining the conventional procedure for manufacturing the conventional high-frequency device, Fig. 15 is a plan view showing the state in which bridge sections of the conventional printed circuit board body have been cut, Fig. 16 is a partially enlarged view showing the state in which the bridge sections of the

printed circuit board body in Fig. 15 are to be cut, Fig. 17 is an exploded perspective view showing the state in which the conventional printed circuit board body and a frame are to be engaged with each other, Fig. 18 is a plan view showing the state in which the conventional printed circuit board body and the frame have been engaged with each other, and Fig. 19 is a bottom view showing the state in which conventional tertiary solder paste is applied.

First, as shown in the chart of Fig. 14 for explaining the manufacturing procedure and the plan view of Fig. 2 showing the printed circuit board body with primary solder paste applied thereto, a first step 1' is a step of applying primary (first) solder paste onto the first surface 21a of a printed circuit board body 20. This application is performed at required positions, though it is not illustrated, where the electric components 21 are to be mounted.

Next, a second step 2' is a step of mounting the chip-like electric components 21 on the first surface 21a of the printed circuit board section 20a with the primary solder paste applied thereon, as shown in Fig. 3.

A third step 3' is a step of soldering the electric components 21 onto the first surface 21a of the printed circuit board body 20 by primary (first) reflow in a reflow furnace, though not illustrated.

A fourth step 4' is a step of applying secondary (second) solder paste onto the first surface 21a of the printed circuit board body 20 to which the electric components 21 are soldered, as shown in Fig. 4. In this step 4', solder paste is applied to points where lead wires of the discrete components 22, such as the aforesaid coil 22b (see Fig. 5), and continuous terminals are inserted.

A fifth step 5' is a step of mounting the discrete components 22, such as the coil 22b and the transformer 22c, and a plurality of continuous terminals 30 onto the second surface 22a of the printed circuit board body 20, as shown in Fig. 5.

A sixth step 6' is a step of soldering the discrete components 22 onto the second surface 22a of the printed circuit board body 20 by secondary (second) reflow in the reflow furnace, though not illustrated.

A seventh step 7' is a step of cutting edge sections (bridge sections) of the printed circuit board body as shown in Figs. 15 and 16, wherein the foregoing bridge sections 20c for connecting the printed circuit board section 20a and the edge sections 20b of the printed circuit board body 20 are cut with a punch (not shown).

Only the printed circuit board section 20a is left in the printed circuit board body 20 after this cutting of the bridge sections 20c. The bridge sections 20c are each cut

along a side edge B of the printed circuit board section 20a, as shown in Fig. 16.

Next, an eighth step 8' is a step of incorporating the printed circuit board section 20a into the frame 10 as shown in Figs. 17 and 18. The printed circuit board section 20a is incorporated into and engaged with the lower side of the frame 10 equipped with the outer side walls 11, the inner walls 12, and the plurality of leg sections 13 so that the second surface 22a of the printed circuit board section 20a having the discrete components 22 mounted thereon faces upward.

At this time, the plurality of leg sections 13 of the frame 10 are inserted through the holes 24 of the printed circuit board section 20a.

Next, a ninth step 9' is a step of applying tertiary (third) solder paste as shown in Fig. 19. Solder paste 40 is applied to peripheral portions of the leg sections 13 of the frame 10 inserted through the holes 24 of the printed circuit board section 20a and soldered sections 32 of the terminals 31, and electrically connecting sections 50a between the outer side walls 11 of the frame 10 and the earth patterns 50, which are located on the first surface 21a.

A tenth step 10' is a step of tertiary reflow in the reflow furnace, though not illustrated. The solder paste

applied in the tertiary solder paste application step is soldered onto the leg sections 13 and the soldered sections 32.

In this step, the frame 10, in which the printed circuit board section 20a having the solder paste 40 thereon is incorporated, is loaded into the reflow furnace (not shown), and the printed circuit board section 20a and the frame 10 are heated in the reflow furnace.

Through the heating in the reflow furnace, the solder paste 40 connects and fixes the leg sections 13 of the frame 10 and the soldered sections 32 of the terminals 31, and the wiring circuit 51 or the earth patterns 50 located near the holes 24 of the printed circuit board section 20a.

In this step, the electric components 21 which have already been soldered are prevented by surface tension of the solder and the like from falling and displacement.

Next, an eleventh step 11' is a step of cutting connecting sections of terminals (see Fig. 10), wherein a connecting section 30a formed at the leading end of each continuous terminal 30 is cut along a cut line C, thereby forming individually isolated terminals 31.

Thus manufactured and completed is the high-frequency device A' in which the frame 10 and the printed circuit board section 20a with the terminals 31 fixed thereon are engaged with and fixed to each other.

However, in the above-mentioned conventional manufacturing method, since the edge sections 20b of the printed circuit board section 20a are cut before the printed circuit board section 20a is incorporated into the frame 10, when the printed circuit board section 20a is incorporated into the frame 10 or transported to the reflow furnace, a finger of an operator or the like may bump the terminals 31 of the printed circuit board section 20a, whereby external force is applied and the terminals 31 are transformed. Furthermore, the external force is exerted on the holes 24 of the printed circuit board section 20a in which the soldered sections 32 of the terminals 31 are tightly fitted, whereby the holes 24 are transformed and the soldered sections 32 of the terminals 31 show a decrease in mounting strength.

Moreover, in the heating by the tertiary reflow (the tenth step 10') in the reflow furnace, radiant heat from the lower surface of the reflow furnace is directly applied onto all the terminals 31 of the printed circuit board section 20a, and oxidation of the terminals 31 thereby proceeds. When the high-frequency device A' provided with the oxidized terminals 31 is incorporated into a mother printed board (not shown) and the terminals 31 are soldered onto the mother printed board, since the oxidized terminals 31 have deteriorated, solderability thereof decreases, which makes

it difficult to achieve stable soldering.

According to one aspect of the present invention, there is provided a method of manufacturing a high-frequency device, comprising the steps of engaging a printed circuit board body, in which a printed circuit board section with a terminal fixed thereon is integrally provided with an edge section and the end of the terminal is covered with the edge section, with a frame, subsequently connecting the frame and the printed circuit board section by solder, and subsequently cutting the edge section of the printed circuit board body.

According to another aspect of the present invention, there is provided a method of manufacturing a high-frequency device, comprising the steps of engaging a printed circuit board body, in which a printed circuit board section with a discrete component and a terminal fixed thereon is integrally provided with an edge section and the end of the terminal is covered with the edge section, with a frame, subsequently and simultaneously connecting the frame, the discrete component and the terminal to the printed circuit board section by solder, and subsequently cutting the edge section of the printed circuit board body.

In the manufacturing method of the present invention,

the step of connecting by solder is performed by a reflow furnace.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a chart showing a manufacturing procedure of a high-frequency device according to an embodiment of the present invention.

Fig. 2 is a plan view of a printed circuit board body of the prior art and the present invention onto which primary solder paste is applied.

Fig. 3 is a plan view showing the state in which chip components are mounted on the printed circuit board body of the prior art and the present invention.

Fig. 4 is a plan view of the printed circuit board body of the prior art and the present invention onto which secondary solder paste is applied.

Fig. 5 is a plan view showing the state in which discrete components are mounted on the printed circuit board body of the prior art and the present invention.

Fig. 6 is an exploded perspective view showing the state in which the printed circuit board body and a frame of the present invention are to be engaged.

Fig. 7 is a plan view showing the state in which the printed circuit board body and the frame of the present invention have been engaged with each other.

Fig. 8 is a plan view showing the state in which bridge sections of the printed circuit board body shown in Fig. 6 have been cut.

Fig. 9 is a partially enlarged view showing the state in which the bridge sections of the printed circuit board body shown in Fig. 8 are to be cut.

Fig. 10 is a partially enlarged view showing the state in which connecting sections of terminals of the present invention are to be cut.

Fig. 11 is a plan view of a high-frequency device according to the present invention.

Fig. 12 is a bottom view of the high-frequency device according to the present invention.

Fig. 13 is a front view of the high-frequency device according to the present invention.

Fig. 14 is a chart showing a conventional high-frequency device manufacturing procedure.

Fig. 15 is a plan view showing the state in which bridge sections of a conventional printed circuit board body have been cut.

Fig. 16 is a partially enlarged view showing the state in which the bridge sections of the printed circuit board body in Fig. 15 are to be cut.

Fig. 17 is an exploded perspective view showing the state in which the conventional printed circuit board body

and frame are to be engaged with each other.

Fig. 18 is a plan view showing the state in which the conventional printed circuit board body and frame have been engaged with each other.

Fig. 19 is a bottom view showing the state in which conventional tertiary solder paste is applied.

Fig. 20 is a plan view of a conventional high-frequency device.

Fig. 21 is a bottom view of the conventional high-frequency device.

Fig. 22 is a front view of the conventional high-frequency device.

A method of manufacturing a high-frequency device A according to an embodiment of the present invention will be described in detail with reference to Figs. 1 to 13.

Some of the figures of the prior art which can be shared are also used in the description of the present invention. Further, the same components as in the prior art are given the same reference numerals.

Fig. 1 is a chart showing a manufacturing procedure of a high-frequency device according to an embodiment of the present invention, Fig. 2 is a plan view of a printed circuit board body of the present invention onto which

primary solder paste is applied, Fig. 3 is a plan view showing the state in which chip components are mounted on the printed circuit board body of the present invention, Fig. 4 is a plan view of the printed circuit board body of the present invention onto which secondary solder paste is applied, Fig. 5 is a plan view showing the state in which discrete components are mounted on the printed circuit board body of the present invention, Fig. 6 is an exploded perspective view showing the state in which the printed circuit board body and a frame of the present invention are to be engaged with each other, Fig. 7 is a plan view showing the state in which the printed circuit board body and the frame of the present invention have been engaged with each other, Fig. 8 is a plan view showing the state in which bridge sections of the printed circuit board body shown in Fig. 6 have been cut, Fig. 9 is a partially enlarged view showing the state in which the bridge sections of the printed circuit board body in Fig. 8 are to be cut, Fig. 10 is a partially enlarged view showing the state in which connecting sections of terminals of the present invention are to be cut, Fig. 11 is a plan view of a high-frequency device according to the present invention, Fig. 12 is a bottom view of the high-frequency device of the present invention, and Fig. 13 is a front view of the high-frequency device of the present invention.

First, as shown in Figs. 1 to 5, first to fifth steps 1 to 5 are the same as the first to fifth steps 1' to 5' of the prior art mentioned above.

Specifically, the first step 1 is a step of applying primary (first) solder paste onto a printed circuit board body 20 as shown in Fig. 2. This application is done by printing. The printed circuit board body 20 is provided with a pair of edge sections 20b projected and connected through bridge sections 20c to the longitudinal side edges of an almost rectangular printed circuit board section 20a.

In other words, the printed circuit board body 20 comprises the printed circuit board section 20a, the edge sections 20b, and the bridge sections 20c.

The pair of edge sections 20b are provided with holes 53 serving as reference points in forming a wiring circuit 51 and the like, engaging holes 54 to be engaged with a transport jig (not shown) in transporting the printed circuit board body 20 by using the transport jig, and the like.

Further, a required wiring circuit 51 (see Fig. 21) is formed on a first surface 21a of the printed circuit board section 20a. This step applies primary solder paste in order to solder chip-like electric components 21, such as chip resistors 21b, chip capacitors 21c and integrated circuits 21d, mounted corresponding to the wiring circuit

51.

Next, the second step 2 is a step of mounting, as shown in Fig. 3, the chip-like electric components 21 on the first surface 21a of the printed circuit board section 20a onto which primary solder paste is applied. In this step 2, the chip resistors 21b, the integrated circuits 21d and the like are mounted on the applied solder paste by using an unillustrated mounter.

The third step 3 is, though not illustrated, a step of soldering the electric components 21 on the first surface 21a of the printed circuit board body 20, on which the electric components 21 are mounted, by primary (first) reflow in a reflow furnace.

The fourth step 4 is a step of applying secondary (second) solder cream 40 onto the first surface 21a of the printed circuit board body 20, on which the electric components 21 are soldered, as shown in Fig. 4. In this step 4, solder paste is applied to points 40a where lead wires of discrete components 22 (see Fig. 5) such as coils 22 are inserted, points 40b where the printed circuit board section 20a is electrically connected to a frame 10, and points 40c where terminals 31 are electrically connected to the printed circuit board section 20a.

The fifth step 5 is a step of mounting the discrete components 22 onto a second surface 22a of the printed

circuit board body 20 as shown in Fig. 5. The discrete components 22 include the coils 22b, transformers 22c, electrolytic capacitors 22d and the like. Further, the terminals 31 of each of a plurality of continuous terminals 30 are connected by a connecting section 30a, and fixed thereon by tight fitting.

As mentioned above, the printed circuit board body 20 comprises the printed circuit board section 20a, the edge sections 20b and the bridge sections 20c, and the electric components 21 such as the chip resistors 21b and the chip capacitors 21c, and the discrete components 22 such as the coils 22b and the transformers 22c are mounted on the first surface 21a and the second surface 22a of the printed circuit board section 20a, respectively.

One of the edge sections 20b is located opposed to and parallel with the plurality of continuous terminals 30 to cover the ends of the continuous terminals 30. The electric components 21 and the discrete components 22 are not mounted on the pair of edge sections 20b.

Next, a sixth step 6 is a step of incorporating the printed circuit board body 20 into the frame 10. As shown in Figs. 6 and 7, the printed circuit board body 20 formed in the aforesaid steps 1 to 5 is incorporated into and engaged with the lower side of the frame 10 provided with outer side walls 11 and inner walls 12 which are each made

of a metal material and formed by stamping and bending, a plurality of leg sections 13, and the like so that the second surface 22a thereof with the mounted discrete components 22 faces upward.

The leg sections 13 of the inner walls 12 of the frame 10 are inserted into the holes 24 of the printed circuit board section 20a.

Next, a seventh step 7 is a step of secondary (second) reflow in a reflow furnace, though not illustrated, wherein the printed circuit board body 20 with solder paste applied thereon is heated and soldered by a single-sided reflow furnace (not shown). This soldering is to solder the discrete components 22 and the terminals 31 onto the printed circuit board section 20a, and simultaneously, to solder the frame 10 to the printed circuit board section 20a. The heating by the single-sided reflow furnace is performed while the printed circuit board body 20 is loaded in the single-sided reflow furnace so that the first surface 21a thereof having the mounted electric components 21 such as the chip resistors 21a faces down. In the heating in the reflow furnace, the printed circuit board body 20 is heated by radiant heat from the inner base of the furnace. At this time, the edge section 20b located opposed to and parallel with the continuous terminals 30 directly receives radiant heat from the base of the reflow furnace, that is, protects

the continuous terminals 30 from the radiant heat. Therefore, the continuous terminals 30 do not directly receive radiant heat from the base of the reflow furnace.

In the soldering in the single-sided reflow furnace, earth patterns 50 and a through groove 23 of the printed circuit board section 20a are electrically connected to the leg sections 13 of the frame 10 (see Fig. 12) as mentioned above, and simultaneously, the discrete components 22 and the terminals 31 mounted on the printed circuit board section 20a are electrically connected by soldering.

The high-frequency device A taken out of the single-sided reflow furnace is composed of the printed circuit board body 20, which is provided with the edge sections 20b and the continuous terminals 30, and the frame 10 as mentioned above.

Next, an eighth step 8 is a step of cutting the edge sections of the printed circuit board body. As shown in Figs. 8 and 9, the pair of edge sections 20b connected to the printed circuit board section 20a through the bridge sections 20c are respectively cut away from the bridge sections 20c along cutting lines D with a punch (not shown), and separated from the printed circuit board section 20a. The cutting lines D are each positioned at a small distance from the outer side wall 11 (the distance L1 is about 1mm) in consideration of cutting with the punch.

Finally, a ninth step 9 is a step of cutting the connecting sections of the terminals, wherein the connecting section 30a at the leading end of each continuous terminal 30 composed of a plurality of terminals 31 is cut along a cutting line C as shown in Fig. 10, and the plurality of terminals 31 are each isolated.

As mentioned above, the assembly and manufacturing of the high-frequency device A shown in Figs. 11 to 13 according to the embodiment of the present invention are completed in the first to ninth steps 1 to 9.

The outward difference between the conventional high-frequency device A' and the high-frequency device A of the present invention is in the cutting position on the bridge section 20c where the edge section 20b is cut away from the printed circuit board section 20a.

Though not illustrated, upper and lower covers each made of a planar metal material are retained on the upper and lower sides of the frame 10, respectively, whereby the high-frequency device is completed.

The number of steps in the embodiment of the present invention is nine, which is two steps (the tertiary solder paste application step and the tertiary reflow step) less than eleven steps in the prior art. This is because the application of solder onto the printed circuit board section and the reflow for the frame, the discrete components and

the terminals are performed simultaneously in the present invention. This step reduction also reduces the cost of manufacturing the high-frequency device A.

According to the high-frequency device manufacturing method of the present invention, since the edge sections remain in the steps of incorporating the printed circuit board section into the frame and soldering thereto, the terminals are protected by the edge sections, and therefore, external force is seldom applied directly to the terminals by a finger of an operator. This prevents transformation of the terminals and rattling due to the loosened fitting of the soldered sections of the terminals before soldering. Consequently, the high-frequency device can be stably incorporated into the mother printed board of a television receiver.

According to the high-frequency device manufacturing method of the present invention, since the frame, the discrete components and the terminals are simultaneously soldered onto the printed circuit board section, the number of the steps is smaller than those of the prior art in which the discrete components, and the frame and the terminals are soldered in separate steps. The step reduction makes it possible to manufacture an inexpensive high-frequency device.

Furthermore, if heating by the reflow furnace is

subsequently and simultaneously connecting said frame, said discrete component and said terminal to said printed circuit board section by solder; and

subsequently cutting said edge section of said printed circuit board body.

4. A method of manufacturing a high-frequency device according to claim 3, wherein said step of connecting by solder is performed by a reflow furnace.

5. A method of manufacturing a high-frequency device substantially as hereinbefore described with reference to, and as illustrated by, the accompanying drawings.

The Patent Office

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Claims searched:	All	**Date of search:**	28 January 1998

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Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H1R(RBS,RBH)

Int Cl (Ed.6): H05K

Other: ON LINE,W.P.I.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2311416 A ALPS	
A	US 4628412 ALPS	

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